

Novel Concept for a Fluidic Hydrophone Capable of Superior Sensitivity and Signal Source Directional Specificity

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Introduction

Given that computer-assisted sonalysis is making possible algorithmic noise filtering of unprecedented effectiveness as well as playing an important role in the advanced technique in which LASER arrays may be used to heat ocean water surrounding a sonar array, thereby turning the water into a lens that allows for the passive sonar system to hear only sounds from a specific range of distances during brief windows of time, there is once again apparent utility in developing passive sonar arrays of greater sensitivity than currently available.

Abstract

Sound and heat are inexorably intertwined. All generated sound may eventually be converted into thermal energy, a physical effect that primarily occurs when sound waves expend the last remnants of their energy. While it is well-known that a noisy room will tend to become overheated, it is not widely understood that it is only in the last several "bounces" of any sound that it is converted into heat. As this energy becomes less intense, phonons begin to scatter in multiple directions rather than moving in organized waves and tend to travel in tightly winding loops during the final phase of their existence. It is only when nuclear oscillation relative to electron cloud position is affected (as opposed to entire atoms) that temperature can be said to increase. When the movement of entire atoms (electron clouds included) occurs, this merely demonstrates the presence of acoustic sound.

A series of tall, thin cylinders filled with a combination of fluid and a spongiform material with a bifurcating, branching structure may be used to deliberately accelerate the degradation of organized sound waves (particularly in a littoral environment) into heat energy. With each wave of organized acoustic energy, the fluid within the cylinder would be incrementally heated. An advanced bolometer could then be used to quantify even the most minute change to temperature over ultra-short timescales.

This differs substantially from the mode of operation of a conventional hydrophone, which seeks to convert pressure directly into electrical impulses. The threshold at which a sound wave may generate detectable heat is far less than that at which it may generate electricity piezoelectrically.

Conclusion

Considering this, as well as advancements made within the past ten years in the field of bolometry, it would make sense to focus on the creation of a mechanism based upon the principle of the deliberate dissipation of acoustic energy into thermal energy in order to facilitate the proxy-detection of sound waves through the measurement of short-period thermal variance so that this novel passive sonar technology may be put to use.